

# A new genus of Buccinoidea (Gastropoda) from Paleocene deposits in eastern Hokkaido, Japan

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## ABSTRACT

A new genus and a new species of the gastropod superfamily Buccinoidea, *Urahorosphaera kanekoi*, is described from the Paleocene Katsuhira Formation in eastern Hokkaido, Japan. This species comprises the first Paleocene record of buccinoid gastropods in Japan and originates from relatively deep-water deposits, which makes it very unique among all Paleocene buccinoidean gastropods in the North Pacific. This occurrence may suggest a trace of bucciniform gastropods diversification similar to the pattern found for the Southern Hemisphere.

*Additional Keywords:* New species, *Brachysphingus*, *Austrosphaera*, *Seymourosphaera*

## INTRODUCTION

Late Cretaceous and Paleocene buccinoidean gastropods of uncertain affinity are known from the North Pacific, Antarctica, and South America. The genus *Brachysphingus* Gabb, 1869 is known from the Paleocene (Danian–Thanetian) of Kamchatka (Gladenkov et al., 1997) and California (Squires, 1997), genus *Austrosphaera* Camacho, 1949 from the Late Cretaceous and Paleocene strata of Tierra del Fuego, and genus *Seymourosphaera* Oleinik and Zinsmeister, 1996 from the Paleocene (Danian) of Seymour Island, Antarctica (Oleinik and Zinsmeister, 1996; Stilwell et al., 2004). The last two genera have once been tentatively included in the subfamily Pseudolivinae Cossmann, 1901 (Oleinik and Zinsmeister, 1996). Vermeij (1998) excluded them from Pseudolivinae based on the lack of a pseudolivid groove and a labral tooth. Based on their occurrence in the Southern Hemisphere, the genera *Austrosphaera* and *Seymourosphaera* most probably belong to the austral family Buccinulidae Finlay, 1928, rather than to the North Pacific family Buccinidae Rafinesque, 1815. All these buccinoid genera share a semi-ovate outline of the shell, predominantly smooth surface, low to moderately elevated spire, short siphonal canal and a poorly developed fasciole.

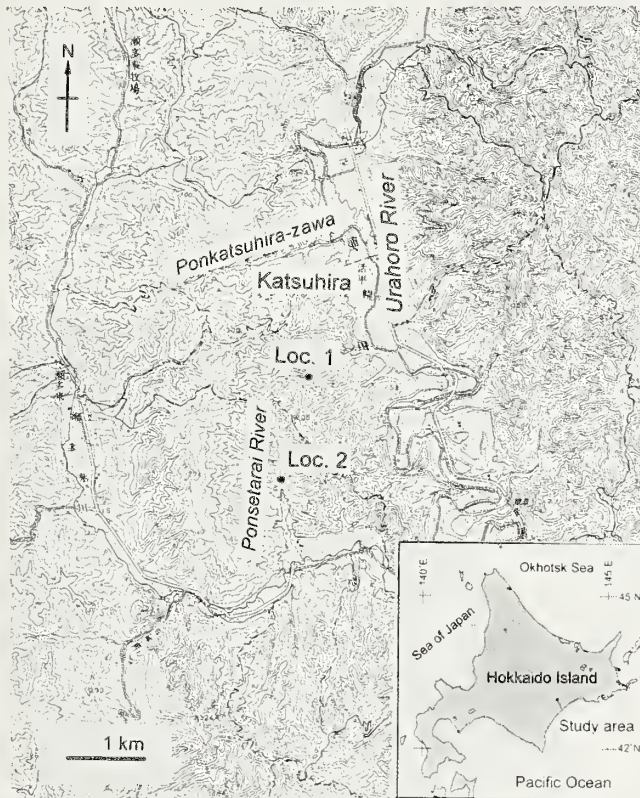
No Paleocene buccinoidean gastropods of similar affinities were previously reported from Japan. Two specimens of smooth-surfaced, subovate buccinids have recently been collected from the Paleocene part of the Katsuhira Formation (Amano and Jenkins, 2014) in eastern Hokkaido. We herein propose a new genus and a new species for these unusual buccinids.

## MATERIALS AND METHODS

Two buccinoidean specimens were collected from two separate carbonate concretions, 20 to 40 cm in diameter, found as floats. Concretions were originally embedded within the mudstone of the Katsuhira Formation, eastern Hokkaido (Figure 1; Loc. 1 and 2). Although most concretions at these localities occurred as floats, they must have been derived from localities nearby. For example, some autochthonous concretions yielding fossils were cropped out 50 m upstream of Loc. 1.

Many calcareous concretions with plant debris are found in the upper part of this formation near the type locality. As discussed by Amano and Jenkins (2014), the age of the upper part of this formation has been assigned to the Paleocene, based on planktonic foraminifers. The age of the upper part of the Katsuhira Formation was assigned to early Selandian, based on planktonic foraminifers and calcareous nannofossils (Kaiho, 1984).

One well-preserved gastropod specimen was obtained from a float calcareous concretion (30 cm in diameter) at 900m upstream of the small river, 1.5 km south to Ponkatsuhira-zawa (Loc. 1). Another, rather poorly preserved specimen was collected from a float calcareous concretion (about 30cm in size) at approximately 1 km upstream of Ponsetarai River (Loc. 2). Multiple fragments of plant material, protobranch bivalves as *Acila*, *Leionucula*, and malletiids, aporrhaid gastropod *Kangilioptera inouei* Amano and Jenkins, 2014 and scleractinian corals are associated with the buccinoidean specimens in both localities. One of the corals was found near the aperture of the poorly preserved specimen at Loc. 2. From other localities of the Katsuhira Formation, deep-water arcoid



**Figure 1.** Locality map of *Urahorosphaera kanekoi* new genus and new species (base map is from “Tokomuro”, scale 1: 50,000 topographical map published by the Geospatial Information Authority of Japan).

*Bentharca* was also found. The paleoenvironments of the Katsuhira Formation has not been studied in any detail. Fossils assemblage is indicative of deep-water accumulation.

Abbreviations used are: JUE: Joetsu University of Education, Joetsu, Niigata Prefecture; FAU: Florida Atlantic University, Boca Raton, Florida; PRI: Paleontological Research Institution, Ithaca, New York.

#### SYSTEMATIC PALEONTOLOGY

Class Gastropoda Cuvier, 1797  
 Order Neogastropoda Wenz, 1938  
 Superfamily Buccinoidea Rafinesque, 1815  
 Family (?)Buccinidae Rafinesque, 1815

**Remarks:** The Buccinidae is one of the most diverse families of neogastropods. Members of the family are distributed from the Equator to the poles, and inhabit exclusively marine environments. The current understanding is to place the northern hemisphere genera in the family Buccinidae, and the southern hemisphere genera in the family Buccinulidae (Bouchet and Warén, 1986; Schnetler, 1997; Harasewych and Kantor, 1999, 2004; Squires and Saul, 2000; Kantor and Harasewych, 2013). Problems of Buccinidae origin, appearance in the fossil

record, and relationship to families Fasciolaridae, Nassariidae, and Melogenidae, have been debated in the literature for some time (Ponder, 1974; Tracey et al., 1993; Bandel, 1993; Kantor, 1996; Ponder and Lindberg, 1997). The phylogenetic relationships of the recent Buccinidae remain unclear. There is no agreement on the exact limits of the family, as well as relationships among its over than 200 genera and subgenera (Harasewych, 1998). The molecular phylogenetic data for buccinids remain insufficient. Whatever phylogenetic data exist mostly point on the paraphyly for the Buccinidae, but also suggest the limited resolving power of current molecular phylogenetic analyses (Hayashi, 2005; Oliverio and Modica, 2010; Kantor et al., 2012).

The fossil record indicates the diversification in bucciniform gastropods during the Late Cretaceous and early Cenozoic. A leading tendency in multiple publications is to place these genera in the present-day families Buccinidae or Nassariidae. Allmon (1990) had commented that placing late Mesozoic and early Cenozoic bucciniform gastropods into a few traditionally recognized living families obscures the phylogeny and leads to underestimation of family-level diversity during this time interval. Squires (1997) had commented that in all probability, Late Cretaceous and early Cenozoic bucciniform gastropods most probably belong to several new undescribed families that are waiting to be properly erected.

It is most likely that the new genus described in this manuscript belongs to a separate, undescribed family of bucciniform gastropods. Limitations in quantity and quality of our material, however, prevent us from designating a new family with confidence at this point.

#### *Urahorosphaera* new genus

**Type Species:** *Urahorosphaera kanekoi* new species, Paleocene (early Selandian), upper part of the Katsuhira Formation, Urahor Town, eastern Hokkaido, Japan.

**Diagnosis:** Shell subovate, inflated; spire low; protoconch bulbous; surface smooth and glossy, except for weak axial riblets near aperture; thick peristomate outer lip; siphonal canal short with weakly developed siphonal notch.

**Description:** Shell medium-sized, thick, with glossy surface, subovate. Last whorl large and globose; spire very low; protoconch smooth and bulbous. Surface of last whorl sculptured by thin and low axial riblets; shallow, but distinct subsutural groove; aperture pear-shaped; outer lip thick, forming peristome; thin callus covering body whorl, spire and protoconch; weakly developed siphonal notch and parietal canal; anterior end of columella abruptly tapered.

**Remarks:** Species in *Urahorosphaera* have broad thin callus covering whole surface. Such character is usually seen in members of the Olivoidea. However, Landau and Marquet (1999) described buccinoidean gastropod, *Cyllene (Cyllenina) lucenensis* from the Pliocene deposit

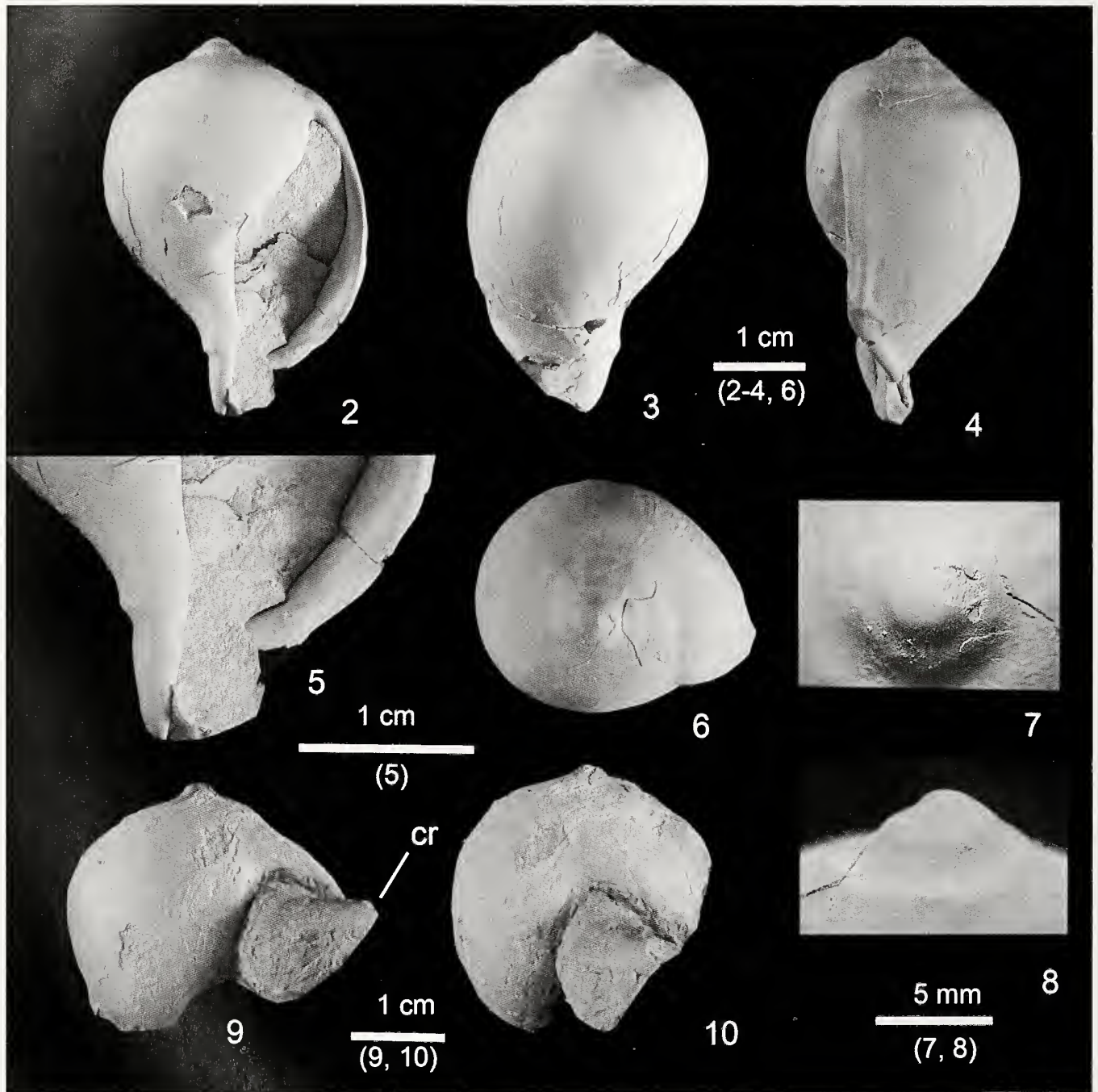


in Spain which has a callus covering teleoconch whorls. This genus is also considered to be an aberrant group within Buccinoidea.

*Urahorosphaera* resembles *Brachysphingus* Gabb, 1869, from the Paleocene to Eocene formations of California in having a subovate shell form, low spire, and short siphonal canal. However, *Urahorosphaera* differs from *Brachysphingus* by having overall larger

size, a smooth glossy shell surface, and a thick outer lip and lacking of spiral cords on the base.

The austral genus *Austrosphaera* Camacho, 1949 (in Furque and Camacho, 1949) from the Late Cretaceous to Paleocene in Argentina is another similar to the *Urahorosphaera* in having overall subovate shell and low spire. *Urahorosphaera* differs from *Austrosphaera* by having a glossy shell surface, wider callus, thick outer



Figures 2-10. *Urahorosphaera kanekoi* new genus and new species. 2-8. Holotype, JUE no. 15924; 2, apertural view; 3, adapertural view; 4, side view; 5, enlargement of base; 6, apical view; 7, apical view of protoconch; 8, side view of protoconch. 9-10. Paratype, JUE no. 15925; 9, apertural view, cr, coral; 10, oblique view of aperture.

lip, and by lacking multiple columellar plications toward the anterior end of the columella.

The Antarctic Paleogene genus *Seymourosphaera* Oleinik and Zinsmeister, 1996 differs from *Urahorosphaera* by having multiple fine spiral threads and poorly developed siphonal canal, and by lacking a siphonal notch.

*Urahorosphaera* differs from *Pangoa* Marwick, 1931, from the Miocene (Lillburnian) of New Zealand by having a more compressed shell with lower spire, shorter siphonal canal, broader callus, and glossy shell surface.

*Urahorosphaera* differs from *Sycostoma* Cox, 1931 from the Eocene of Europe and North America by having a more rounded semi-ovate shell, lower spire, wider callus, shorter siphonal and weakly developed parietal canals, and larger bulbiform protoconch.

The genus *Liochlamys* Dall, 1889 (family Fascioliariidae) from the Neogene of the southeastern United States, although has a glossy shell surface, overall globose shape of the shell, and bulbiform protoconch, differs from the *Urahorosphaera* by having two to three columellar folds, or plications, wider and more elongated siphonal canal, higher spire, and presence of apertural ribs in the interior of the aperture.

**Etymology:** The new genus is named after the town of Urahor, site of the type locality in Hokkaido.

**Age and Occurrence:** Paleocene Katsuhira Formation in Urahor, eastern Hokkaido.

***Urahorosphaera kanekoi* new species**

Japanese name: Urahor-migaki-bora  
(Figures 2–10)

**Diagnosis:** Same as that of the new genus.

**Description:** Shell medium-sized, attaining 43.0 mm in height, thick, polished, subovate with four whorls. Last whorl large and globose; spire very low, covered by

thin glaze, comprising approximately 1/6 of the total shell height; protoconch smooth, bulbous, low-domed, consisting of 1.5 whorls. Surface of last whorl sculptured by twelve thin and low axial riblets near aperture; riblets becoming obsolete anteriorly. Subsutural groove very shallow, but distinct. Aperture pear-shaped; outer lip thick, forming distinct peristome. Outer lip forming blunt angle near boundary between base and posterior end; columella concave and smooth; inner lip broadly covered by thin calcareous callus; callus extending over front of shell and over parietal sinus, covering suture and protoconch; siphonal canal short and slightly oblique with weakly developed siphonal notch; parietal canal weakly developed; anterior portion of columella tapering abruptly.

**Type Material:** Holotype, JUE no. 15924 (shell height, 43.0 mm; diameter, 29.5 mm); Paratype, JUE no. 15925 (diameter, 28.2 mm).

**Type Locality:** 900 m upstream of the small river, 1.5 km south to Ponkatsuhira-zawa, Urahor, eastern Hokkaido.

**Remarks:** *Urahorosphaera kanekoi* new species shares a subovate shell with low spire and generally smooth surface with *Brachysphingus mammilatus* Clark and Woodford, 1927 (especially paratype UCMP 31235; see Squires, 1997, figs. 5–10, 11) from the upper Paleocene and lower Eocene in California, and with *Brachysphingus gibbosus* Nelson, 1925 from the early Paleocene of Kamchatka (Figures 11–12). However, *Urahorosphaera kanekoi* new species differs from these species by the presence of a thick outer lip, suddenly tapering anterior end and lack of spiral cords on the basal part. *Urahorosphaera kanekoi* is similar to *Seymourosphaera bulloides* Oleinik and Zinsmeister, 1996 (Figures 13–14,) in general shape and smooth surface, but differs by a higher spire, thicker peristome, suddenly tapering anterior end, and broader callus.



**Figures 11–14.** Paleocene smooth-surfaced subovate gastropods. 11, 12. *Brachysphingus gibbosus* Nelson, 1925. PRI 49420. 11, aperural view; 12, abapertural view. Paleocene, Danian, Getkilninskaya Formation, Northwestern Kamchatka. 13, 14. *Seymourosphaera bulloides* Oleinik and Zinsmeister, 1996. FAU 18384-11. 13, aperural view; 14, abapertural view. Paleocene, Danian, Sobral Formation, Seymour Island, Antarctica.



**Etymology:** The new species is named for Mr. Atsushi Kaneko who collected the holotype.

**Distribution:** Known from the type locality and 1 km upstream of Ponsetarai River, Katsuhira Formation, Urahoro, eastern Hokkaido.

## DISCUSSION

Most of the North Pacific buccinids, other than the Paleocene through middle Eocene genera *Siphonalia* and *Snatolia* (Family Siphonaliidae, according to Goryachev, 1987, Oleinik, 1988, and Gladenkov et al., 1988), appeared in the late Eocene and their diversity gradually increased from the late Eocene to recent following the general trend of climatic cooling in the region (Titova, 1994; Gladenkov et al., 1997). The Late Cretaceous and Paleocene record of the North Pacific Buccinidae remains rather poorly known. Apart from apparently buccinoidean, highly sculptured gastropods, such as genera *Ornopsis* Wade, 1916 and *Deussenia* Stephenson, 1941 from the Late Cretaceous and Paleocene of California and northern Mexico, the only early Paleocene buccinoidean gastropod, morphologically similar to *Urahorosphaera*, in the northern circum-Pacific, is the genus *Brachysphingus*. Three species of *Brachysphingus* (*B. gibbosus* Nelson, 1925, *B. sinuatus* Gabb, 1869, and *B. mammilatus* Clark and Woodford, 1927) are known from the uppermost Cretaceous (?)–lower Paleocene strata of California and Baja California (Squires, 1997). Two species (*B. sinuatus* and *B. gibbosus*) are known from the Paleocene Getkilninskaya Formation of northwestern Kamchatka (Gladenkov et al., 1997), which comprises the northernmost record of this genus in the northern circum-Pacific. The distribution of the genus *Brachysphingus* in the Paleocene of the northern circum-Pacific follows the general pattern outlined by Oleinik (2001). At that time, marine isotopic records do not indicate a significant departure in temperature values from the Late Cretaceous and do not indicate a significant thermocline of depth (Bralover et al., 2002; Dutton et al., 2005), with some indications of warmer temperatures (Adate et al., 2002) during the early Paleocene. These paleoceanographic conditions would promote the dispersal of molluscan faunas across the northern rim of the Pacific Ocean which explains similarity of the eastern North Pacific and northwestern Pacific Paleocene molluscan faunas. Paleocene molluscan faunas from Japan remained virtually unknown until recently (Amano and Jenkins, 2014). The new genus *Urahorosphaera* is morphologically distinct from the *Brachysphingus*, showing more similarity with the austral genera *Austrosphaera* and *Seymourisphaera* that diversified in the southern hemisphere. Discovery of the *Urahorosphaera* in the lowermost upper Paleocene of Hokkaido may suggest a trace of similar early Paleocene diversification in the North Pacific. The genus *Brachysphingus* in the Paleocene of the North Pacific is also known from a shallow-

marine deposits represented by lithic sandstone and associated with shallow-water bivalves. On the other hand, the lithology and assemblage of the Katsuhira Formation, from which *Urahorosphaera* was found, is indicative of relatively deep-water deposits, which makes it unique among other North Pacific Paleocene localities. Somewhat similar deep-water assemblages are found in the lower portion of the Getkilninskaya Formation of northwestern Kamchatka, but those do not contain *Brachysphingus*, *Urahorosphaera*, or any aporroid gastropods.

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